REMARKS/ARGUMENTS

Reconsideration of the above-identified application is respectfully requested in view of the foregoing amendments and the following remarks. Claims 1 and 2 have been amended. New claim 8 has been added. Claims 1-8 remain in the case.

The present invention pertains to radiation detectors and a method of making same. More specifically, the present invention is a fundamentally new approach for growing semi-insulating $Cd_xZn_{1-x}Te$ ($0 \leq x \leq 1$) crystals with full active volume for detecting radiation in the 1 keV – 5 MeV photon energy range.

Claims 1-7 were rejected under 35 USC §103(a) for obviousness from the teachings of U.S. Patent Nos. 7,067,008 for PROCESS FOR THE PRODUCTION OF CD XTE SEMICONDUCTOR CYRSTALS WITH HIGH RESISTIVITY AND RESULTING CRYSTALLINE MATERIAL issued June 27, 2006 to Kazandjian et al. (hereinafter "Kazandjian et al."); 5,314,651 for FINE-GRAIN PYROELECTRIC DETECTOR MATERIAL AND METHOD issued on May 24, 1994 to Kulwicki (hereinafter "Kulwicki"); and 4,907,043 for POLYCRYSTALLINE ELECTROLUMINESCENT DEVICE WITH LANGMUR-BLODGET FILM issued on March 6, 1990 to Uekita et al. (hereinafter "Uekita et al.").

Claim 1 recites a radiation detector made from a compound comprising: $Cd_x.Zn_{1-x}Te$,where $0 \leq x \leq 1$; and an element from column III or column VII of the periodic table in a concentration of about 10 to 10,000 atomic parts per billion; and a rare earth element selected from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb and Lu in a concentration of about 10 to 10,000 atomic parts per billion.

Applicants acknowledge the Examiner's argument that Kazandjian et al. disclose a compound comprising $Cd_xZn_{1-x}Te$ (hereinafter "CdZnTe") where ($0 \leq x \leq 1$) and an element from column III of the periodic table in a concentration of about 10 to 10,000 atomic parts per billion, and an additional element in concentration of about 10 to 10,000 atomic parts per billion. However, Applicants respectfully disagree that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have the additional element taught by Kazandjian et al. be a rare earth element as mentioned in Kulwicki and Uekita et al.

In *KSR v. Teleflex* (hereinafter "*KSR*"), the Federal Circuit found that in order to evaluate whether a given combination was obvious, a factfinder must "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR International, Co. v. Teleflex, Inc.,* 127 S. Ct. 1727, 1742-1743 (2007).

Kazandjian et al. involves only elements from column III of the periodic table (column 6, lines 49-50) and no rare earth elements. Applicants' invention, however, uses elements from column III or column VII of the periodic table. Further, Kulwicki mentions combining donor elements Nb, TA, Bi, Sb, Y, La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er with acceptors such as Co, Cu, Fe, Mn, Ru, Al Ga, Mg, Sc, K, Na, U, In, Mg, Ni, or Yb. (column 2, lines 2-9) While Applicants agree that the acceptor elements are rare earth metals, the donor elements mentioned in Kulwicki are all from column II of the periodic table using barium strontium titanate, not CdZnTe, as Applicants' invention.

Additionally, as stated above, and unlike either Kazandjian et al. or Kulwicki, Applicants' invention deals with combining elements from columns III or VII of the periodic table with the rare earth elements. Also, neither reference discloses or suggests using group VII elements. In addition, it would not be apparent to one of ordinary skill in the art to use group VII elements because they have more electronegativity than those from group II or III. Thus, one of ordinary skill in the art would not necessarily know if they would react in the same manner with the rare earth elements. Also, Group III and VII elements have impurities that can serve as donors that compensate for the effect of acceptors such as cadium vacancies when using CdZnTe. This is not necessarily the case when combining a donor element including barium strontium titanate as mentioned in Kulwicki. Thus, initially using these two references, one of ordinary skill in the art would not know to combine CdTnZe with

column VII elements and still be able to achieve the desired effects to create a radiation detector.

The Examiner further argues that Uekita et al. teaches that examples of polycrystalline thin films using CdTe and ZnTe; and that these materials are usually doped with rare earth elements. However, Uekita et al. also disclose doping the thin films with Mn, Cu, Ag, and rare earth fluorides such as TbF_3, SMF_3, ERF_3, HoF_3, PrF_3, and TMF_3 in addition to the rare earth elements. Thus, while Examiner argues that one of ordinary skill in the art from all three references may be able to realize the combination of CdTnZe with a rare earth element to form an invention, Applicants respectfully disagree. The additional elements in Uekita, Mn, Cu, and Ag, are electron acceptors and not donors. Claim 1 of Applicants' invention does not require that addition of those electron acceptors or the rare earth fluorides to CdTnZe.

Thus, Applicants respectfully disagree with Examiner, in that one of ordinary skill in the art would NOT know to make Applicants' invention using the prior art. Chemistry reactions are very specific to the attributes of each element of the equation. Thus, one of ordinary skill would not find it apparent to use a compound of CdZnTe combined with rare earth elements mentioned in Uekita et al. and Kulwicki, with elements from column III mentioned in Kazandjian et al. to create the reaction. The rare earth fluorides and

electron acceptors that are taught as a combination with the CdZnTe in Uekilta et al. are not present in Applicants' invention.

In addition, Applicants' invention can use elements from column III or VII, none of the prior art mentions using elements from column VII. In other words, combining dopants in the presence of new materials, while lacking other materials from prior art, and achieving the same effect as taught in the three references, could not be predicted or apparent, by one of ordinary skill in the art.

The Kazandjian et al., Kulwicki, and Uekita et al. documents, either individually or in combination, do not teach or suggest that there was an apparent reason to combine the known elements in the fashion recited in claim 1. Thus, there was no motivation to combine them. Accordingly, these documents cannot render obvious claim 1.

Amended claims 2-4 and 6 involve an independent claim with five dependent claims related to a method of forming a radiation detector compound mixture of Cd, Zn and Te that is heated to a liquid state. Electron donors from column III or column VII of the periodic table are added to the top of a band of the mixture when it is solidified. Rare earth metals are added to the middle band of the mixture as well. The donors have a concentration of 10 to 10,000 atomic parts per billion.

As Examiner acknowledges Kazandjian et al. does not explicitly teach that first dopant adds shallow level donor electrons to the top of an energy band gap or that the second dopant adds deeps level donors to the middle of the band gap of the mixture when it is solidified. However, Applicants respectfully disagree with Examiner's other allegations regarding Kulwicki and Uekita et al. Examiner alleges that Kulwicki teaches doping polycrystalline with an element from column II of the periodic table, such as Al, GA, or IN, and a rare earth element, such as La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, or Er. He further alleges that doping with Al, Ga, or IN will add shallow level donors to the top of an energy band gap of the mixture when it is solidified and that doping with La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, or Er will add deep level donors and to the middle of the band gap of the mixture when it is solidified.

Additionally, Examiner alleges that Uekita et al. teach that examples of polycrystalline matter are CdTe and ZnTe and that these materials are usually doped with rare earth elements. However, while Uekita et al. disclose the use of rare earth elements in CdTe and ZnTe, they also disclose using Mn, Cu, and AG alone with rare earth fluorides. One of ordinary skill in the art would realize that Mn, Cu, and AG are acceptor elements. Acceptor elements are different from donor elements in that one accepts electrons and the other donates electrons, respectively. Amended claim 2 does not recite the use of any acceptor elements. Therefore, Kalwicki along with Uekita et al.

and Kazandjian et al. do not make apparent Applicants' invention to one of ordinary skill in the art.

Kalwicki discloses doping polycrystalline with an element from column III. This cannot be said to be the same as doping CdZnTe with elements from column VII and rare earth metals. In addition, because Uekita et al. mention doping polycrystalline material with rare earth fluorides and acceptor elements in addition to the donor elements, the references combined can NOT suggest that Applicants' invention could be formed by one ordinarily skilled in the art.

In sum, unlike what Examiner alleges, it would not have been obvious to one of ordinary skill in the art at the time of the invention was made to try having the first dopant taught by Kazandjian et al, be Ga or In, and the second dopant be Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, or Er as taught by Kulwicki to form Applicants' invention when neither reference mentions using elements from column VII of the periodic table or CdTnZe as the polycrystalline material.

Combining those references with Uekita et al. still does not suggest Applicants' invention because the invention lacks the necessary acceptors and metal fluorides. The Federal Circuit stated that "...the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not." *Leapfrog*

Enters., Inc. v. Fisher-Price, Inc., 485 F.3d 1157, 1162 (Fed. Cir. 2007). It would not be common sense for one of ordinary skill in the art to know that the current invention would work with the current elements minus the additional elements in Uekita et al. and minus the barium strontium titanate in Kulwicki and combined with elements from column VII. Those column VII elements were not mentioned in ANY of the prior art references.

Therefore, Kazandjian et al., Kulwicki, and Uekita et al. cannot render obvious independent claim 2 or the claims dependent therefrom.

Regarding the rejections of claims 5-7, the Examiner alleges that Kazandjian teaches a concentration of the first dopant and of the second dopant in the compound is about 10 to 10,00 atomic parts per billion. The dopant referenced in Kazandjian et al. is iron. Claims 5 -7 are dependent claims; therefore, the mere fact that a reference suggests the amount of iron to be used as a dopant, which is not the same as a rare earth metal as in Applicants' invention, does not suggest such use.

Lastly, regarding claims 1-7, *KSR* affirmed *Graham v. John Deere* in holding that "Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented..." *KSR International, Co. v. Teleflex,*

Inc., 127 S. Ct. 1727, 1728 (2007). Applicant's invention is created to fulfill such a long felt need by providing a radiation detector made from a compound or alloy that has excellent carrier transport property, which fully depletes in response to an applied electric field, as well as a method for forming this compound. (Description of Related Art [0007]). This means that the invention is more sensitive to radiation detection than the prior art because the more depleted the response to the electric field, the more sensitive the device is to radiation. This is an unsolved need and an advantage compared to the references cited by Examiner.

In view of the foregoing amendments and remarks, Applicants respectfully request that claims 1-8, as amended, be allowed, and the application passed to issue.

Respectfully submitted,

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